CLAIMS

What is claimed is:

1. A cochlear stimulation system for capturing and delivering fine time structure (FTS) in incoming sounds, the system comprising:

an electrode array, having a plurality of electrodes for placing into a duct of a human cochlea;

a plurality of stimulation channels connected to the electrode array, each stimulation channel connected to at least one electrode in the electrode array;

an envelope extractor for extracting a slowly varying frequency envelope in the incoming sound;

an FTS analyzer for estimating the FTS information within a frequency band; and

a current navigator, which uses the identified dominant FTS component at each band of frequency and precisely directs, employing virtual electrodes, stimulation to each place of the cochlea that spatially corresponds to the identified dominant FTS component.

2. The system of claim 1, wherein the plurality of electrodes numbers between about 16 to 22.

3. The system of claim 1, wherein the FTS analyzer includes a software that employs Fast Fourier Transform to de-construct the incoming sound, within a pre-determined time interval, into dominant FTS components that are located in various frequency bands.

4. The system of claim 1, wherein the lead is inside the scala tympani.

5. The system of claim 1, wherein the FTS analyzer includes a software that extracts the number of zero-crossings in a pre-determined time interval to calculate the dominant FTS component in a frequency band.

6. The system of claim 5, wherein the pre-determined time interval is at least about 10 milliseconds.

7. The system of claim 1, wherein the FTS analyzer includes a software that extracts the averaged time duration between zero-crossing in a pre-determined time interval, in order to calculate the dominant FTS component in a frequency band.

8. The system of claim 7, wherein the pre-determined time interval is at least about 10 milliseconds.

9. The system of claim 1, wherein the current navigator linearly adds the carrier frequency and the dominant FTS component provided by the FTS analyzer, and wherein the current navigator precisely directs the stimulation to various electrodes.

10. The system of claim 1, wherein the cochlear stimulation system employs a K of L stimulation strategy.

11. A cochlear stimulation method for capturing and delivering FTS in incoming sounds, wherein the stimulation is provided by a plurality of electrodes in an electrode array connected to a multi-channel stimulator, the method comprising:

analyzing the incoming sounds within a plurality of frequency bands;

extracting the slowly varying frequency carrier component of the incoming sound in each frequency band with an envelope;

estimating the dominant FTS component in each frequency band using an FTS analyzer;

adding the dominant FTS component to the carrier component to provide a precise corresponding spatial location on the cochlea; and

directing the stimulation current, using a current navigator, to the precise spatial place on the cochlea.

12. The method of claim 11, wherein the plurality of electrodes numbers between about 16 to 22.

13. The method of claim 11, wherein virtual electrodes are implemented either by simultaneous, weighted current steering or non-simultaneous, alternating, time-multiplexed presentation of stimuli in at least two electrode contacts.

14. The method of claim 11, further comprising:

placing the electrode array inside the scala tympani.

15. The method of claim 11, wherein estimating the dominant FTS component is accomplished by using software in the FTS analyzer that extracts the number of zero-crossings in a pre-determined time interval.

16. The method of claim 14, wherein the pre-determined time interval is at least about 10 milliseconds.

17. The method of claim 11, wherein estimating the dominant FTS is accomplished by the FTS analyzer that de-constructs incoming sounds in a predetermined time interval, employing Fast Fourier Transformation.

18. The method of claim 17, wherein the pre-determined time interval is at least about 10 milliseconds.

19. The method of claim 11, wherein the step of adding the FTS information to the carrier is accomplished by linearly adding the two.

20. The method of claim 19, wherein the stimulation system employs a K of L stimulation strategy.

21. The method of claim 11, wherein the step of directing the stimulation current is accomplished by using virtual electrodes.

22. The method of claim 11, wherein estimating the dominant FTS is performed by taking the average of the time duration of intervals between zero-crossings.